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Edited by:
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Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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Chapter 3

Some Aspects of Improved Machinability in Preheated Machinining of Titanium Alloy Ti-6Al-4V

A.K.M. Nurul Amin[1]*, M. Abdelgadir[1], K. Kamaruddin[1]
[1]Department of Manufacturing and Materials Engineering, Faculty of Engineering, IIUM, Jalan Gombak, 53100 Kuala Lumpur, Malaysia. *Corresponding author:

*e-mail address of corresponding author: akamin@iiu.edu.my

1.0 INTRODUCTION

Titanium and its alloys have found wide application in the aerospace, biomedical and automotive industries owing to their good strength-to-weight ratio and high corrosion resistance. However, these alloys have very poor machinability, which is attributed to their inherent high strength maintained at elevated temperature and low thermal conductivity. High chemical reactivity of titanium at high elevated temperatures, especially with titanium based tools or coatings limit their application during machining. The strategy of titanium machining is to use tools which show less reactivity, has higher thermal conductivity to increase the chip-tool contact length and effectively take away the generated heat and to use tougher and harder tools which could withstand the dynamic action of the cutting force. The recommended tools for many years had been the uncoated tungsten carbide grade K. However, modern trend is to use Poly Crystalline Diamond (PCD) tools for machining of this particular alloy. In this work the effectiveness of PCD has been compared to that of uncoated tungsten carbide tool in machining titanium alloy Ti-6Al-4V. The comparison has been made in terms of the applicable cutting speed ranges, tool wear rates, tool wear morphology, chip segmentation and chip-tool contact lengths.

Titanium and its alloys have been experiencing extensive development over the past few decades stimulated by a series of their unique properties, such as, high strength to weight ratio maintained at elevated temperatures, high fracture resistance and exceptional resistance to corrosion at temperatures below 500 ^{0}C. Though the initial applications of Titanium alloys have been in the aerospace industries in aero-engine and airframe manufacture, there is a growing trend in their application in the industrial sector, which includes petroleum refining, chemical and food processing, surgical implantation, nuclear waste storage, automotive and marine applications. Despite the increased usage and production of titanium and its alloys, these materials fall under the category of the most difficult to machine materials which is attributed to